ERASMUS

HELLENIC MEDITERRANEAN UNIVERSITY

COURSE OUTLINES

Department of Electronic Engineering

School of Engineering

Academic Year 2026-2027

TABLE OF CONTENTS

AI TOOLS FOR LEARNING AND INNOVATION

COURSE OUTLINE

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	8000.1.205.0	**SEMESTER**	2nd
COURSE TITLE	AI tools for learning and innovation		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
	2	4
Total	**2**	**4**

COURSE TYPE general background, special background, specialised general knowledge, skills development	Theoretical & Practical
PREREQUISITE COURSES	There are no prerequisites for this course. It also applies to any semester.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes

- Explain the fundamental concepts, capabilities, and limitations of generative AI and large language models.
- Identify and compare AI tools used for learning, research, communication, content creation, employability, and innovation.
- Apply appropriate AI tools to academic and professional tasks, including research, writing, presentations, brainstorming, and project development.
- Evaluate the accuracy, reliability, bias, and suitability of AI-generated outputs critically.
- Apply ethical principles related to academic integrity, transparency, privacy, copyright, and responsible AI use.
- Design and develop digital content using AI-supported tools, including presentations, websites, images, videos, and customized chatbots.
- Formulate effective prompts and refine interactions with AI systems to produce relevant and context-appropriate results.
- Collaborate effectively in multicultural and international virtual teams using digital communication and project-management platforms.
- Plan and organize an international online or hybrid academic event using appropriate project-management methods and digital tools.

General Competences

- Understanding the principles, capabilities and limitations of generative AI and large language models.
- Selecting and comparing AI tools according to specific academic, professional and creative needs.
- Critically evaluating AI-generated content for accuracy, reliability, bias, relevance and quality.
- Applying ethical, transparent and responsible practices when using AI, particularly regarding academic integrity, privacy and copyright.
- Using AI tools effectively for research, writing, learning, communication, employability and problem-solving.
- Designing effective prompts and refining interactions with AI systems to achieve appropriate outcomes.
- Creating AI-supported digital outputs, including presentations, websites, images, videos and customized chatbots.

3. SYLLABUS

- AI Fundamentals.
- How to think about using AI - the concept of fusion skills.
- Learn how to prompt.
- AI responsible use.
- AI tools for presentation purposes.
- AI tools for research communication.
- AI tools for career development purposes.
- AI as an evaluator of your work.
- AI tools for vibe coding.
- How to create your chatbot.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	- Synchronous lecture sessions and attention of seminars in a hybrid format.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	• Use of the Learning Management System (e-class) to access, download the lecture notes, and upload assignments. • Use of the Zoom platform as a teleconference tool. • Use of Mentimeter as a polling platform. • Use Kahoot as an assessment platform to evaluate students' understanding.
TEACHING METHODS The manner and methods of teaching are described in detail.	(see table below)
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	The enrolled students should register for all of the following assessment stages: • Active Participation in the sessions - 50% • Homwework/Assignments - 20% • Final Exam - 30%

Activity	Semester workload
Lectures	25
Attending Seminars / Colloquial Talks	10
Homework / Assignments (Collaborative Work)	75
Course total	**110**

5. ATTACHED BIBLIOGRAPHY

- Distributed Lecture Notes

CULTURAL COMMUNICATION

COURSE OUTLINE

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	8000.1.240.0	**SEMESTER**	
COURSE TITLE	Cultural Communication		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
	1	1
Total	**1**	**1**

COURSE TYPE general background, special background, specialised general knowledge, skills development	Theoretical & Practical
PREREQUISITE COURSES	There are no prerequisites
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	https://iro.hmu.gr/all-english-courses/

2. LEARNING OUTCOMES

Learning outcomes

This course aims to develop students' intercultural awareness, prepare them to communicate and interact effectively in culturally diverse environments, and to engage constructively with misunderstandings and disagreements. Particular emphasis is placed on recognizing and overcoming stereotypes, understanding diverse cultural values and communication practices, and cultivating openness to cultural diversity. Students will also consider how cultural assumptions and differing communication practices can contribute to misunderstandings and conflict, and how such situations can be approached constructively. Through collaborative and reflective activities, students will explore other cultures and strengthen their ability to communicate, collaborate, and engage across cultural differences. The course therefore supports both intercultural competence and the development of constructive conflict-resolution skills in international academic and professional environments.

At the end of the course:

- Identify and critically discuss stereotypes and prejudices in intercultural contexts.
- Compare direct and indirect communication practices/indirect and low & high-context communication practices across cultures.
- Explain how cultural values influence everyday behaviors, communication, and daily life.
- Analyze simple intercultural misunderstandings and conflicts from multiple cultural perspectives, and identify constructive engagement and resolution strategies.
- Listen to and engage respectfully with perspectives that differ from their own, including in situations of disagreement.

- Collaborate effectively with students from different cultural backgrounds.
- Reflect critically on their own cultural assumptions and intercultural learning.

General Competences

- **Intercultural awareness:** Ability to recognize, critically examine, and challenge stereotypes and prejudices in intercultural interactions.
- **Intercultural communication:** Ability to adapt communication to direct/indirect and high-/low-context cultural practices.
- **Cultural interpretation:** Ability to interpret how cultural values shape communication, behavior, and everyday practices.
- **Intercultural conflict management:** Ability to analyze intercultural misunderstandings from multiple perspectives and apply constructive engagement and conflict-resolution strategies.
- **Respectful dialogue:** Ability to listen actively, acknowledge differing perspectives, and communicate respectfully during disagreement.
- **Intercultural collaboration:** Ability to work effectively and responsibly with peers from diverse cultural backgrounds toward shared goals.
- **Critical cultural self-reflection:** Ability to identify and critically reflect on one's own cultural assumptions, biases, and intercultural learning.

3. SYLLABUS

The course consists of 6 synchronous online sessions, but also requires participants to organize their asynchronous meeting sessions & tasks. More particularly:

Synchronous Part

All the synchronous sessions will be one hour long. They will be planned as follows:

- A 10- 15-minute introductory lecture from an academic: principles & presentation, theoretical framework, tasks students will perform in virtual rooms.
- A 30- 40-minute synchronous collaboration activity for various student teams in virtual rooms.
- 10-minute presentations/reflections by the students' teams on their findings in virtual rooms. The lecturer will briefly synthesize the findings across groups, identify similarities and differences, and connect them to the concept of intercultural communication.
- All sessions will take place **every Monday, starting on the 12th of October 2026, from 16:00 - 17:00 CET** via Zoom. The COIL **will be completed on the 16th of November 2026**.

We will plan 6 such synchronous activities. The proposed ones are:

- Session #1: Orientation to the COIL activity / Introduction to the course (60 minutes)
- Session #2: Stereotypes, prejudice, and intercultural misunderstandings (60 minutes)
- Session #3: High-context vs. low-context communication across cultures (60 minutes)
- Session #4: Cultural Storytelling (60 minutes)
- Session #5: Values, Cultural Difference, and Constructive Conflict Engagement (60 minutes)
- Session #6: Multinational Students' Group Presentations & Reflections (90 minutes)

Asynchronous Part

- **After each session, students should complete a short group or individual follow-up task**. For example, after the session on stereotypes, each group could upload one stereotype they reconsidered; after the high-/low-context session, they could provide one authentic communication example; after the storytelling session, one short cultural narrative; and after the conflict session, one brief conflict-resolution case.

- **Each student will submit his/her a reflective journal**: We strongly recommend four short reflection entries, one after each thematic session, with a final synthesis at the end. Each synchronous session will be followed by a short asynchronous activity linked directly to the session topic. Students will document their learning progressively through group outputs and individual reflective entries. More specifically, a set of four questions students should respond to can be:
  - **What happened**? Describe one interaction, idea, or moment that attracted your attention.
  - **Why was it important?** Explain what surprised you or challenged your previous assumptions. What challenged or surprised me?
  - **How can intercultural communication theory explain it?** Connect the experience with one concept introduced during the course.
  - **What will you do differently in the future? Explain how this learning could influence your behavior when studying, working, or living in another cultural environment.**
  - (For the final entry - at the end of the COIL activity): Revisit your initial assumptions about other cultures and identify whether any of them changed.

Each entry should not be more than 150 words.

4. TEACHING and LEARNING METHODS - EVALUATION	
DELIVERY Face-to-face, Distance learning, etc.	Synchronous (online) and Asynchronous Sessions
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	We will use ZOOM as the teaching platform for synchronous sessions. Other digital tools will be used during the synchronous parts: • Padlet to reflect on your opinions and findings as individuals after each session. • Mentimeter for polling purposes. • Kahoot as a gamification element. • Google Sheets and Docs for your reflective journal actions.
TEACHING METHODS The manner and methods of teaching are described in detail.	<table><tr><td>**Activity**</td><td>**Semester workload**</td></tr><tr><td>**Course total**</td><td></td></tr></table>
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	The assessment will happen as follows: • **Participation in the synchronous sessions (50%)**; Assess active contribution, respectful intercultural communication, listening, collaboration, and engagement in the international group. You need to attend at least 4 of the 6 planned synchronous sessions, with the final session being mandatory. • **Contribution to the group assignment (30%);** Assess the quality of the collaborative output, integration of multiple cultural perspectives, teamwork, and clarity of presentation. • **Submission of the reflection journal (20%);** Assess critical reflection on stereotypes, cultural differences, misunderstandings, adaptation, and personal intercultural learning. It is also strongly recommended that you participate in any course-related surveys.

5. ATTACHED BIBLIOGRAPHY
• Trainers' notes and recorded sessions

INTRODUCTION TO PLASMA ENGINEERING

COURSE OUTLINE

Responsible: Ioannis Fytilis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	8000.1.008.0	**SEMESTER**	Winter/Spring
COURSE TITLE	Introduction to Plasma Engineering		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
	3	4
Total	**3**	**4**

COURSE TYPE general background, special background, specialised general knowledge, skills development	Specialization course
PREREQUISITE COURSES	Basic knowledge of electromagnetism and optics (Lorentz force, e/m waves formalism, Maxwell equations, dielectric\magnetic constant, refractive index, refraction, etc.)
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Both Winter and Spring Semesters
COURSE WEBSITE (URL)	https://eclass.hmu.gr/courses/EE344/

2. LEARNING OUTCOMES

Learning outcomes

The course introduces the students to the fundamental of plasma and the applications of plasma technology. After completing the course, the student will be able to:

- understand the plasma phase of the matter, the unique properties it has and the different types of plasmas.
- calculate/evaluate basic plasma parameters
- mention the different formulations of plasma description and where could be applied
- recognize the different type of waves that could develop/propagate in plasmas and their properties
- have knowledge of the different technologies of plasma sources and their properties
- describe various plasma applications and choose the proper plasma sources
- use proper diagnostics for plasma sources characterization
- mention and describe the various type of dense plasma generators and their applications.

General Competences

Decision-making, Independent work, Exercising criticism and self-criticismm Generating new research ideas, Promoting free, creative and inductive thinking

3. SYLLABUS

- Introduction to plasma: definitions, properties, Debye shielding, temperatures- densities, types of plasmas, plasma frequency.
- Plasma descriptions: particle motion, kinetic description, two-fluid description, magneto-hydrodynamic (MHD) description, ideal-MHD, plasma conductivity.
- Waves in plasma: waves in non-magnetized plasma, phase velocity, refractive index, critical density. Waves in magnetized plasma, cutoff-resonance, MHD waves.
- Plasma sources: electric discharge tubes, plasma torch, corona discharge, Dielectric Barrier discharge, RF discharge, Microwave discharge. Electron beam plasmas. Laser plasmas.
- Plasma applications: Material processing, nanolithography, plasma antennas, plasma monitor, plasma thrusters, spectroscopy, sterilization.
- Plasma diagnostics: diagnostics of magnetic field, current, particle flow, refractive index, spectroscopy. Diagnostics with X-rays, ion beam.
- Dense plasma & applications: pulsed power plasma devices. Z-pinch, plasma instabilities, X-pinch & other pinch configurations, Dense Plasma Focus, Tokamak, Stellarator. high photon energy sources, particle acceleration, fusion energy.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	Face-to-face theoretical teaching. Problem solving.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	Use of slide presentation software. Electronic communication with students
TEACHING METHODS The manner and methods of teaching are described in detail.	(see table below)
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	Written exams 40%, exercises-questionnaires 30%, short project presentation 30%.

Activity	Semester workload
Lectures	36
Problem Solving	10
Personal study	52
Short project	20
Examination	2
Course total	**120**

5. ATTACHED BIBLIOGRAPHY

1. Introduction to Plasma Technology: Science, Engineering and Applications, J.E. Harry, 2010, Wiley?VCH, ISBN Print:9783527327638 Online:9783527632169
2. Plasma Physics and Engineering, A. Fridman, L.A. Kennedy, 2011, CRC Press, ISBN 9781439812280
3. Plasma Engineering: Applications from Aerospace to Bio and Nanotechnology, 1st edition (or 2nd edition), M. Keidar , I. Beilis, 2013 (2018), Academic Press, ISBN: 978-0123859778 (978-0128137024)
4. Principles of Plasma Physics for Engineers and Scientists, U.S. Inan, M. Golkowski, 2011, Cambridge University Press, ISBN 13:9780521193726

ORGANIC ELECTRONICS DEVICES

COURSE OUTLINE

Responsible: Georgios Kakavelakis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	8000.1.022.0	SEMESTER	Winter/Spring
COURSE TITLE	Organic Electronics Devices		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	WEEKLY TEACHING HOURS	CREDITS
	2	4
Total	**2**	**4**

COURSE TYPE general background, special background, specialised general knowledge, skills development	Erasmus
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Both Winter and Spring Semesters
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes

Upon completion of the subject, students will be able to:

- Understand the physics behind organic semiconductors
- Understand electronc transport mechanism in the organic semiconductors.
- Identify the molecules that can be used for different functions in organic electronics
- Chose a proper method (or different methods) for fabricating particular component
- Understand the importance of interfaces and morphology for organic electronics
- Gain an introductory knowledge on organic solar cells and organic LEDs

General Competences

Understanding Organic Semiconductor Physics, Operating Principles of Key Devices, Structure-Property Relationships, Fabrication & Processing Techniques, Device Characterization, Multidisciplinary Communication, Technical English Fluency.

3. SYLLABUS

- Introduction to Organic Electronic
- Electronic transport in crystalline organic materials and conductive polymers

- Conducting Polymers, small molecules organic semiconductors,
- Polymer organic semiconductor,
- Electrical and optical properties of organic semiconductors.
- Basic Organic LED structure, thin film layers: Hole injection, hole transport, emissive, electron transport and electron injection layers used in organic LEDs.
- Fabrication and characterization techniques.
- Recent advances in organic solar cells and LEDs

4. TEACHING and LEARNING METHODS - EVALUATION	
DELIVERY Face-to-face, Distance learning, etc.	Project
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	
TEACHING METHODS The manner and methods of teaching are described in detail.	**Activity** / **Semester workload** **Course total** /
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	Oral Presentation (50%) Final Exam (50%)

5. ATTACHED BIBLIOGRAPHY
Lecture notes

STRUCTURED PROGRAMMING

COURSE OUTLINE

Responsible: Nikolaos Spanoudakis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	0806.1.001.0	**SEMESTER**	1st
COURSE TITLE	Structured Programming		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	5
Total	**5**	**5**

COURSE TYPE general background, special background, specialised general knowledge, skills development	
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Winter Semester
COURSE WEBSITE (URL)	https://eclass.hmu.gr/courses/EE369/

2. LEARNING OUTCOMES

Learning outcomes

Upon successful completion of the course, the student will be able to:

- Find solutions to problems of moderate difficulty, describe the algorithmic solutions in pseudo-code and/or in a flowchart, and write the C code.
- Evaluate algorithmic solutions.
- Design and implement software applications that access text files.
- Design and write code for programs that require the use of vectors or arrays whose elements are structured items.
- Use a sorting or searching technique appropriate to the situation.

General Competences

- Searching, analysis and synthesis of data and information, with the use of the necessary technologies
- Decision-making
- Team work
- Time management
- Project planning and management
- Oral communication
- Criticism and self-criticism

- Promotion of free, creative and inductive thinking
- Use of computers

3. SYLLABUS
Introduction to Informatics and Computers. Introduction to the parts of the computer (hardware) and the computer programs (software). Numbering systems and conversions from one system to another. The concept of the algorithm. Algorithm structures. Logic diagrams (flowcharts). Programming in the C language. Data types and sizes. Control statements. Relational and logical operators. Loop statements. Functions and program structuring into blocks. One-dimensional/multi-dimensional arrays. Address pointers. Recursion and recursive functions. Ways of defining data structures and data unions as well as the operators used to access their members. Introduction to search techniques (Sequential Search, Binary Search) and sorting (Sort by Selection, Bubble Sort). File access. Learning the basic principles of designing and implementing programs in an Integrated Development Environment (e.g. CODE::BLOCKS, Dev-C++, VS code).

4. TEACHING and LEARNING METHODS - EVALUATION	
DELIVERY Face-to-face, Distance learning, etc.	Face-to-face theoretical teaching. Laboratory training in groups of students (20 per group). Tutorial exercises in small groups of students.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	Use of slide presentation software. Use of an integrated software development environment (IDE) such as CODE::BLOCKS or VS code. Communication with students via an asynchronous e-learning platform (eclass).
TEACHING METHODS The manner and methods of teaching are described in detail.	

Activity	Semester workload
Lectures	26
Laboratory exercises	13
Tutorial Exercises	26
Group assignment carried out in small groups	35
Self-study	50
Course total	**150**

STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	I. Written final examination (FE) (40-80%) - Problem solving - Multiple-choice questions - Short-answer questions II. Laboratory examination (LE) (20%) - Multiple-choice questions - Short-Answer Questions - Problem Solving III. Written mid-term test (MT) (20%) - Problem solving - Multiple-choice questions - Multiple-choice questions IV. Group assignment (GA) (20%) - Marking of the Submitted Assignment - Oral Examination - Public Presentation The course grade (FE*0.4 + LE*0.2 + MT*0.2 + GA*0.2) must be at least five (5). Students must have no more than one absence from the laboratory exercises. The FE can range from 40 to 80 percent in cases where students have missed an item (MT or GA) with the needed justification. Laboratory examination (LE) is compulsory and cannot be ommitted (20%). The assessment criteria are available to students on the course website and are announced in the first lecture.

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Greek or translated textbooks:

- N. Hatzigiannakis, The C language in depth, Kleidarithmos Publications, 5th revised edition, 2017.
- G. S. Tselikis and N. D. Tselikas, C: From Theory to Practice, 4th edition, 2023.
- Bradley L. Jones, Peter Aitken,Dean Miller, Complete Manual of C, 7th Ed., X. GKIOURDAS & CO. LP, 2015Paul Deitel, Harvey Deitel, C Programming, 9th Edition, X. GKIOURDAS & CO. LP, 2023.
- Paris Mastorokostas. Procedural programming. The C language. KALLIPOS Open Academic Editions, 2015

Foreign-language textbooks:

- Israel Gbati. Bare-Metal Embedded C Programming: Develop high-performance embedded systems with C for Arm microcontrollers. Packt Publishing, 2024
- Robert C. Seacord. Effective C, 2nd Edition: An Introduction to Professional C Programming. No Starch Press, 2024

COMPUTER ARCHITECTURE

COURSE OUTLINE

Responsible: Nikolaos Petrakis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	0806.4.001.0	**SEMESTER**	1st
COURSE TITLE	Computer Architecture		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
	2	5
Total	**2**	**5**

COURSE TYPE general background, special background, specialised general knowledge, skills development	
PREREQUISITE COURSES	Highly recommended to have enough knowledge of "Structured Programming" and "Digital Systems Design" .
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Winter Semester
COURSE WEBSITE (URL)	https://eclass.chania.teicrete.gr/courses/

2. LEARNING OUTCOMES

Learning outcomes

Familiarity with the internal structure and basic operations of a computer as well as gaining knowledge in the organization and design of the hardware and software that make up a typical computing system. Emphasis will be placed on the lower levels, the level of digital logic and the design of the central processing unit.

Programming in machine language and in symbolic language (assembly).

Understand processor organization, memory, datapath and input / output structures.

Upon successful completion of the course students will be able to:

- Explain the purpose of CPU, I / O subsystems, and various storage subsystems.
- Understand the Instruction Set Architecture (ISA) of a machine, its design and implementation.
- Distinguish computers based on their set of instructions.
- Describe the modern methodology for evaluating and comparing processor performance.
- Describe how to internally represent integer and real (floating point) numbers (IEEE 754) and perform conversions according to the standard.
- Describe the basic ways of addressing and give examples of instructions that use them.
- Describe the technique of partially overlapping operations and its expected benefits.
- Know the low level programming rules and execute code including defining and calling procedures, leaf-

procedures, but also non-leaf procedures using the stack correctly.

• Understand the relationship between hardware and software and the relationship between low-level programming and high-level programming.

• Understand the implementation of the control unit either as a classical sequential circuit or with the technique of microprogramming.

• To know the basic principles that govern the organization of modern processors, and some modern research trends in the field of computer architecture.

• Use the MIPS emulator of the MIPS processor for programming at the machine language level.

General Competences

Search, analysis and synthesis of data and information, using the necessary technologies

Decision making

Autonomous work

Teamwork

Project design and management

Exercise criticism and self-criticism

Promoting free, creative, and inductive thinking

3. SYLLABUS

Compulsory course for students in the field of computer organization and computer architecture.

Reference to historical data on the evolution of computers and categories of computer systems.

RISCs and CISCs.

The internal structure of a modern thirty-two-bit processor (MIPS32) is gradually revealed through the study of its instruction set. Also, reference is made to issues of design of computer systems with parallel processing (MIMD, SIMD).

Categories of computer applications and their characteristics.

Structure and basic operations of a typical computer. Study of the instruction repertoire.

Machine language - representation of instructions on the computer.

Symbolic language (assembly language). High level programming language support.

Hardware support for procedures (leaf procedures and non-leaf procedures).

Addressing modes. Signed / unsigned integer representation.

Arithmetic and logic unit and arithmetic and logic operations.

Representation of real (floating point) numbers (IEEE 754) and operations with them.

Computer evaluation and understanding of performance.

Address and data paths and datapath design.

Control unit and timings. Microprogram development.

Increase efficiency by pipelining.

Main memory. Auxiliary memory. Cache memory. Virtual Memory. Memory technology.

Content Addressable Memories (CAM).

Input / Output Units.

Using the various tools (SPIM or MARS) introduced in the course, students should explore in depth several aspects of computer architecture and / or organization to achieve a more complete understanding.

4. TEACHING and LEARNING METHODS - EVALUATION	
DELIVERY Face-to-face, Distance learning, etc.	Face to face theoretical teaching. Laboratory training in groups of students (maximum 20 students per group). Practice exercises in small groups of students.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	Use of slide show software Use of an Integrated Development Environment (IDE) like MARS 4.5, which is a very easy-to-use MIPS assembler, developed at the University of Missouri. Communication with students through an asynchronous distance learning platform.
TEACHING METHODS The manner and methods of teaching are described in detail.	<table><tr><td>**Activity**</td><td>**Semester workload**</td></tr><tr><td>**Course total**</td><td></td></tr></table>
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	I. Written final exam (WFE) (70%) - Problem solving / calculations - Comparative evaluation of theory elements II. Laboratory test (LT) (15%) - Laboratory work / technical reports / measurements in small groups III. Examination in practice exercises (PE) (15%) - Individual practice tasks The grade of the course (WFE * 0.7 + LT * 0.15 + PE * 0.15) must be at least five (5.0). The grade of each of I, II, III must be at least three (3.0). The assessment criteria are accessible to students from the course website and are announced in the first course.

5. ATTACHED BIBLIOGRAPHY

- *Suggested textbooks:*

- D. A. Patterson, J. L. Hennessy, *Computer Organization and Design – The Hardware / Software Interface*, 5th ed., Morgan Kaufman Publishers, 2014.
- J. L. Hennessy, D. A. Patterson, *Computer Architecture: A Quantitative Approach*, 6th ed., Morgan Kaufman Publishers, 2018.

DIGITAL SIGNAL AND IMAGE PROCESSING

COURSE OUTLINE

Responsible: Georgios Giannakakis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	0806.4.003.0	SEMESTER	2nd
COURSE TITLE	Digital Signal and Image Processing		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	WEEKLY TEACHING HOURS	CREDITS
Lectures	3	5
Total	**3**	**5**

COURSE TYPE general background, special background, specialised general knowledge, skills development	
PREREQUISITE COURSES	Signals and Systems
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Winter Semester
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes

The course aims to

- analyze discrete-time signals and systems using the Z-transform, the DFT and FFT algorithms
- design and implement FIR and IIR digital filters according to frequency-response specifications
- apply image enhancement techniques in the spatial and frequency domains
- select image restoration and compression methods appropriate to the requirements of the application
- implement signal and image processing algorithms in Matlab and document the results in a technical report

General Competences

Search for, analysis and synthesis of data and information, with the use of the necessary technologies

Decision-making

Autonomous work

Promotion of free, creative and inductive thinking

3. SYLLABUS

Discrete-time signals and the sampling theorem, fundamental principles of digital systems, linear convolution and linear difference equations. The Z-transform. Definition, properties. The inverse Z-transform. The discrete

Fourier transform. The fast Fourier transform and FFT algorithms. Implementation of digital filters. Basic filter types. Difference equations and digital filtering. Difference equations and the transfer function. Pole-zero diagram and stability. Frequency response of a digital filter.

Introduction to the theory of digital filters. Applications of discrete-time signals and systems. Analysis and design of digital filters. Digital filter structures, IIR filter design, FIR filter design.

Introduction to Digital Image Processing and applications. Basic concepts: elements of visual perception, light and the electromagnetic spectrum, image acquisition, sampling and quantisation, mathematical tools. Intensity transformations. Histogram processing. Filtering in the spatial domain, spatial smoothing and sharpening filters. Filtering in the frequency domain: sampling and the Fourier transform of sampled functions, the 2-D discrete Fourier transform and its properties, filtering in the frequency domain, smoothing and sharpening filters in the frequency domain. Image restoration: noise models, restoration in the presence of noise only, estimation of the degradation function, inverse filtering, Wiener filtering. Image compression: basic concepts and compression methods (lossy and lossless).

Use of computational packages for the design of filters.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	Written exams and project
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	
TEACHING METHODS The manner and methods of teaching are described in detail.	<table><tr><th>Activity</th><th>Semester workload</th></tr><tr><td>**Course total**</td><td></td></tr></table>
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	

5. ATTACHED BIBLIOGRAPHY

Greek or translated textbooks:

- Continuous- and Discrete-Time Signal Processing, Kafentzis Georgios, 2019
- Digital Signal Processing - Principles, Algorithms and Applications, Proakis J.G., Manolakis D., 2024
- Continuous- and Discrete-Time Signals and Systems with Matlab and Octave, 3rd Edition, Paraskevas Michalis, 2022.
- Digital Signal Processing, Veloni Anastasia, Myridakis Nikolaos, 2018
- Basic Techniques of Digital Signal Processing, 2nd Edition, Moustakides Georgios V., 2022
- Digital Signal Processing, 1st Revised Edition, Antoniou A, 2022
- Digital Image Processing, 4th Edition, Gonzales, Stefanos Kollias (ed.), 2018
- DIGITAL IMAGE PROCESSING AND ANALYSIS, PAPAMARKOS NIKOLAOS, 2013

Foreign-language textbooks:

- Li Tan, DigitalSignal Processing – Fundamentals and Applications, AacademicPress, Elsevier, 2008.
- Proakis J.G. & D.G. Manolakis, “Introduction to Digital Signal Processing”, MacMillan Publ., 1994.
- Chassaing R., “Digital Signal Processing Lab Experiments”, Wiley, 1999.
- IEEE Transactions on Image Processing

ANALOG AND DIGITAL CONTROL

COURSE OUTLINE

Responsible: Georgios Fouskitakis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	0806.4.005.0	**SEMESTER**	2nd
COURSE TITLE	Analog and Digital Control		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	5
Total	**5**	**5**

COURSE TYPE general background, special background, specialised general knowledge, skills development	
PREREQUISITE COURSES	Mathematics, Physics I, Signals and Systems
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek or English
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Both Winter and Spring Semesters
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes

The purpose of the course is for students to acquire the theoretical and practical background in Automatic Control Systems (ACS) in both continuous and discrete time and their applications. The course aims to introduce students to the fundamental concepts of Automatic Control Systems. The course covers the following thematic areas: (a) Description of continuous-time systems in the form of transfer functions, (b) Analysis of transfer functions: Calculation of characteristic system metrics in the time and frequency domains, (c) Design of closed-loop systems PID controllers, (d) Design of closed-loop control systems using the Ziegler-Nichols empirical method, (e) Analytical design of closed-loop control systems using the pole placement method: Design in continuous and discrete time, (f) Calculation of steady-state errors and system type for closed-loop systems.

The course is accompanied by laboratory-type applications via the MATLAB and Simulink simulation environments.

Learning Outcomes:

Upon completion of the course, students should be able to utilize the acquired knowledge to: (a) Analyze and study the behavior of a linear dynamic system, (b) Design controllers and study their impact and performance on the response behavior of the closed-loop system.

General Competences

Decision-making

Teamwork (or *Group work*)

Oral presentation of group work

Criticism and self-criticism

Promotion of free, creative and inductive thinking

3. SYLLABUS
Representation of dynamic systems with transfer functions System analysis in the time and frequency domains Stability analysis Block diagram algebra Closed-loop control systems PID controllers Control System Design using the Ziegler-Nichols method Simulation of closed-loop control systems Control SystemDesign using the pole placement method Calculation of steady-state errors Closed-loop control system type

4. TEACHING and LEARNING METHODS - EVALUATION	
DELIVERY Face-to-face, Distance learning, etc.	Oral presentations
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	MS Power point, e-class, Matlab, Simulink, LaTeX,
TEACHING METHODS The manner and methods of teaching are described in detail.	(see table below)
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	Mid-term test, Final test, Groups of theoretical and laboratory exercises.

Activity	**Semester workload**
Groups of theoretical exercises, Groups of Laboratory Exercises, Mid-Term, test, Final Test	150
Course total	**150**

5. ATTACHED BIBLIOGRAPHY
Benjamin Cuo and Farid Golnaraghi, Automatic Control Systems, John Wiley, 8th Edition, 2003.

CAD/CAM SYSTEMS, 3D MODELING AND REVERSE ENGINEERING

COURSE OUTLINE

Responsible: Emmanouil Maravelakis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	0806.7.014.0	**SEMESTER**	1st
COURSE TITLE	CAD/CAM Systems, 3D Modeling and Reverse Engineering		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
Seminars	4	5
Total	**4**	**5**

COURSE TYPE general background, special background, specialised general knowledge, skills development	Επιλογής υποχρεωτικό
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Winter Semester
COURSE WEBSITE (URL)	https://iro.hmu.gr/introduction-to-history-of-crete-and-greece-electronic-engineering-courses/

2. LEARNING OUTCOMES

Learning outcomes

- Identify and describe the main stages of the product development process and determine the appropriate digital tools for each phase.
- Explain the various applications of 3D models, including production of photorealistic images, CNC machining, finite element analysis (CAE/FEM), rapid prototyping/additive manufacturing (RP/AM), and virtual reality.
- Analyze the principles of concurrent and collaborative engineering and evaluate their contribution to product development time optimization.
- Design products using parametric modeling and geometric features.
- Manage complex assemblies and design sheet metal components.
- Evaluate reverse engineering applications in specialized fields such as medicine, quality control, documentation of obsolete components, and cultural heritage preservation.
- Select the appropriate Computer-Aided Manufacturing (CAM) system for product manufacturing.

General Competences

- Search, analysis and synthesis of data and information, using the CAD/CAM technologies
- Decision making
- Autonomous work
- Teamwork
- Project design and management

- Promoting free, creative, and inductive thinking

3. SYLLABUS

Introduction to Computer-Aided Design and Manufacturing (CAD/CAM) systems,.CAD tools for mechanical product design and manufacturing, CAD tools for electronic applications, industrial design, and CAM tools. Process planning and CNC programming. Product design, 3D modeling, and functional analysis using Computer-Aided Engineering (CAE) and Finite Element Analysis (FEA). Evolution of CAD systems, industrial applications of CAD/CAM technologies, typical CAD/CAM workflows in manufacturing environments. 3D product models and their applications. Introduction to 3D CAD modeling, feature-based parametric modeling, sheet metal design, assemblies, and data exchange between CAD systems. Introduction to reverse engineering. Contact and non-contact 3D data acquisition techniques. Structured-light and laser 3D scanners, scanning methodologies, and best practices. Low-cost 3D modeling techniques using photogrammetry. Large-scale terrestrial laser scanning & applications. Medical applications based on computed tomography (CT) and magnetic resonance imaging (MRI) data. Closed-surface (watertight) 3D models. Applications of 3D models in Virtual Reality (VR), Augmented Reality (AR), and multimedia. Applications of 3D documentation and digital preservation in cultural heritage.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	Classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	
TEACHING METHODS The manner and methods of teaching are described in detail.	(see table below)
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	I. Written final exam (WFE) (80%) - General questions - Problem solving / calculations - Comparative evaluation of theory elements II. Individual Project (IP) (20%) - Laboratory work / technical reports / measurements in small groups

Activity	Semester workload
Lectures	26
Laboratory exercises	26
Individual study	59
Preparation of laboratory work / technical reports in small groups	39
Course total	**150**

5. ATTACHED BIBLIOGRAPHY

- Warren, T. (2026). *Autodesk Fusion 360 for beginners 2026: Step-by-step CAD, 3D modeling, and CAM made simple for students, makers, and hobbyists*. Independently published.
- Merton, J. (2026). *Master FreeCAD 1.1.1 2026: A step-by-step beginner's guide to parametric 3D design from scratch*. Independently published
- Sugden, J. O., & Manley, J. (2024). *Mastering Autodesk Fusion 360* (2nd ed., 2024–2025): 27 step-by-step projects for beginners in 3D printing, prototyping, and making. Sliceform LLC.

POWER ELECTRONICS

COURSE OUTLINE

Responsible: Ioannis Chatzakis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	0806.8.009.0	SEMESTER	Winter/Spring
COURSE TITLE	Power Electronics		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	WEEKLY TEACHING HOURS	CREDITS
	2	4
Total	**2**	**4**

COURSE TYPE general background, special background, specialised general knowledge, skills development	Scientific Area, Skills Development
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Both Winter and Spring Semesters
COURSE WEBSITE (URL)	https://eclass.hmu.gr/courses/EE111/

2. LEARNING OUTCOMES

Learning outcomes

The power electronics course focuses the attention of students, who already know most of the possibilities of electronics, on the elimination of losses, introducing switching methods suitable to replace linear operation. The electronic components that they already know are now examined, along with new ones, from another perspective, that of operating as switches. Attention is focused on any disadvantages of switching methods and how to deal with them. Upon successful completion of the course, the student will be able to:

- Know how to design to minimize losses.
- Have knowledge of the effect of the characteristics of the components on the switching function.
- Know how to implement a power electronics device in order for it to operate effectively.

General Competences

Searching, analyzing and synthesizing data and information, using the necessary technologies Decision-making Autonomous work, Exercising criticism and self-criticism, Promoting free, creative and inductive thinking

3. SYLLABUS

Definition of the concept of "Power Electronics", Power semiconductors (Diode, Thyristor, GTO, MCT, TRIAC, Power BJT, Power MOSFETs, SJ MOSFET, IGBT, HEMT, TRIAC), Circuits with switches and diodes (with RC, RL, RLC load), semiconductor protection, oscillation damping - snubbers, MOVs, di/dt limiting coils, fuses, current sensors - protection through driving. Rectifiers, polyphase rectifiers, thyristor controlled rectifiers. RL and LC low-pass filters, Fourier analysis, use of harmonic spectrum in power electronics, ripple factor (K), total harmonic distortion factor (THD), harmonic factors (HF), power factor (PF). DC/DC conversion, Buck converter, DC and AC coil operation, Boost converter, DC and AC coil operation, Polarity reversal converter. Definition of Duty Cycle and control using a reference voltage and using a triangular or sawtooth pulse (PWM). Switching power supplies, power factor correction (PFC), the pulse transformer, forward converter, half-bridge, bridge, Push-Pull, coupled coils, Flyback converter. Inverters: Half-bridge, Bridge, PWM technique, MPWM technique, PDM technique, Modulation Factor (Mf), SPWM technique, Normalized carrier frequency (Fnc), HF-Link, three-phase inverters, Inverters and motors., Class-D amplifiers, Class-E. Integrated Circuits and Power Electronics, switching regulators, DC/DC converters, PFC controllers, power semiconductor driving, PWM units, Microcontrollers and DSP for power electronics. Feedback control and correction techniques. Cycloconverters, and other applications of Power electronics.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	Face to face theoretical teaching.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	Use of PowerPoint presentations. Electronic communication with students
TEACHING METHODS The manner and methods of teaching are described in detail.	(see table below)
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	I. Written final exam - Problem solving/calculations - Comparative evaluation of theory elements The evaluation criteria are accessible to students from the course website and are announced in the first lesson.

Activity	Semester workload
Lectures	26
Personal study	92
Exam	2
Course total	**120**

5. ATTACHED BIBLIOGRAPHY

Suggested Bibliography:

- "Power Electronics", Lander C.
- "Power Electronics", Brandley B.
- "Power Electronics", Williams B.
- "Power Electronics", Rashid M.

SOFT AND RESEARCH SKILLS DEVELOPMENT

COURSE OUTLINE

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	MH10A4	**SEMESTER**	
COURSE TITLE	Soft and Research Skills Development		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
		5
	2	
Total	**2**	**5**

COURSE TYPE general background, special background, specialised general knowledge, skills development	
PREREQUISITE COURSES	There are no prerequisites for this course
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes

- Communicate scientific ideas clearly in written, oral, and digital formats.
- Collaborate effectively in multidisciplinary and intercultural teams.
- Apply critical thinking, problem-solving, creativity, and decision-making skills.
- Demonstrate effective time management, adaptability, leadership, and conflict-resolution skills.
- Formulate research questions, objectives, and testable hypotheses.
- Conduct systematic literature searches and critically evaluate academic sources.
- Prepare and present a structured research proposal, report, poster, or scientific presentation.
- Apply principles of research ethics, academic integrity, referencing, and responsible use of artificial intelligence.
- Disseminate your scientific work using social media.

General Competences

- Scientific communication across written, oral, and digital formats.
- Effective collaboration in multidisciplinary and intercultural teams.
- Critical thinking, problem-solving, creativity, and evidence-based decision-making.
- Time management, adaptability, leadership, negotiation, and conflict resolution.
- Formulating research questions, objectives, and hypotheses.

- Conducting literature searches and critically evaluating scientific sources.
- Applying research ethics, academic integrity, referencing standards, and responsible use of artificial intelligence.
- Preparing and presenting research proposals, reports, posters, and scientific presentations.
- Reflecting on personal, academic, and professional development.

3. SYLLABUS

The content of the course includes the following topics:

- How to make oral presentations in public.
- How to develop your collaboration and networking skills.
- How to develop your cultural intelligence skills.
- How to develop your critical thinking and problem-solving skills.
- How to develop your leadership skills.
- How to manage your time effectively.
- How to resolve conflict situations.
- How to read a scientific paper.
- How to write a scientific paper.
- How to prepare a poster presentation.
- Research ethics and integrity.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	- Synchronous lecture sessions and attention of seminars in a hybrid format.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	• Use of a Learning Management System (e-class) for finding lecture notes and uploading your assignments. • Use of the Zoom platform for the online sessions. • Use of Mentimeter for polling surveys. • Use of Kahoot to evaluate understanding of each session.
TEACHING METHODS The manner and methods of teaching are described in detail.	see table below
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	The enrolled students should participate in all of the following assessment steps. • Active Participation: 50% • Weekly Assignments: 30% • Final Exam: 20%

Activity	Semester workload
Lectures	25
Attending Seminars / Colloquial Talks	10
Homework / Assignments (Collaborative Work)	75
Exams	2
Course total	**112**

5. ATTACHED BIBLIOGRAPHY

- Lecture notes of the lecturer.
- Presentation slides of the invited speakers.

AN INTRODUCTION TO LASER PHYSICS AND APPLICATIONS

COURSE OUTLINE

Responsible: Konstantinos Petridis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	MEN1.2	SEMESTER	2nd
COURSE TITLE	An Introduction to Laser Physics and Applications		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	WEEKLY TEACHING HOURS	CREDITS
	2	4
Total	**2**	**4**

COURSE TYPE general background, special background, specialised general knowledge, skills development	Theoretical
PREREQUISITE COURSES	There are no prerequisites for this course
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Spring Semester
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes

- Explain the fundamental principles of light–matter interaction, including absorption, spontaneous emission, and stimulated emission.
- Describe the conditions required for laser operation, including population inversion, optical amplification, and feedback.
- Explain the basic characteristics of laser radiation, including coherence, monochromaticity, directionality, intensity, and polarization.
- Analyze the operation of optical resonators and describe the formation of longitudinal and transverse modes.
- Understand continuous-wave and pulsed laser operation.
- Distinguish between different types of lasers, including solid-state, gas, semiconductor, fiber, and dye lasers.
- Communicate the principles and applications of laser technology through technical reports, problem-solving activities, and oral presentations.

General Competences

- Applying the fundamental principles of light–matter interaction, including absorption, spontaneous emission, and stimulated emission.
- Explaining the physical conditions required for laser operation, including population inversion, optical gain, and feedback.

- Identifying the main components of a laser system and evaluating their functions.
- Distinguishing among solid-state, gas, semiconductor, fiber, and dye lasers.
- Analyzing the main properties of laser radiation, including coherence, monochromaticity, directionality, intensity, and polarization.
- Interpreting the operation of optical resonators and the formation of longitudinal and transverse modes.
- Calculating fundamental laser parameters, including wavelength, frequency, photon energy, optical power, intensity, beam divergence, and pulse energy.
- Differentiating between continuous-wave, pulsed, Q-switched, and mode-locked laser operation.

3. SYLLABUS

The course will contain the following topics:

- The three fundamental processes to generate light: absorption, spontaneous emission, and stimulated emission.
- The properties of laser light.
- The three building blocks of a laser device: Pump Source, Medium, and an Optical Amplifier.
- Types of Pumping Sources and related laser systems.
- What do we define as the threshold point? What is population inversion, and how many energy states do we need to achieve population inversion?
- Types of optical amplifiers. The stability/loss diagram.
- Longitudinal and Transverse laser modes.
- The saturation mechanism. The various spectral broadening mechanisms.
- How to generate laser pulses: the Q-Switching and Mode-Locking Techniques.
- Controlling the polarization of the laser light.
- Applications of laser light in medicine, environment, and military areas.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	- Synchronous lecture sessions and attention of seminars in a hybrid format.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	• Use of the Zoom platform • Use of a Learning Management System to download the lecture sessions, respond to your assignments, and upload your homework. • Use of the Mentimeter tool for polling activities during the lecture sessions. • Use of the Kahoot tool for understanding the outcomes of each session.
TEACHING METHODS The manner and methods of teaching are described in detail.	

Activity	Semester workload
Lectures	25
Homework & Assignments	75
Final Exam	2
Course total	**102**

STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	• Active Participation: 50% • Homework: 30% • Final Exam: 20% The students should be engaged in all of the above assessment processes.

5. ATTACHED BIBLIOGRAPHY
• Lecturer's teaching notes. • LASERS by Siegman

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